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ScienceDirect

Procedia Manufacturing 3 (2015) 6109 – 6115

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Work at height: Neglect or improvisation in civil construction in Brazil and Uruguay?

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Abstract

Work at heights in the construction industry is responsible for a large number of occupational accidents. In Brazil, despite the relevant security-related legislation, it is possible to find situations of neglect and improvisation in various construction sites. The aim is to promote the debate about labor safety at construction sites. This article discusses the similarities between the labor safety laws of Brazil and Uruguay. After visits to construction sites in the cities of Recife (Brazil) and Montevideo (Uruguay) it was possible to observe both ergonomic and labor safety problems. After analyzing the perception of risk, improvement suggestions were generated.

Peer-review under responsibility of AHFE Conference

Keywords: Macroergonomics; Labor safety; Construction; Work at height

1. Introduction

The construction activity has several tasks that can be considered arduous. Workers are exposed to hazardous actions, such as manual lifting of heavy materials, improper body postures, difficult machine control, tiring monitoring of processes etc. Several activities are strenuous, like digging holes, use of machinery and electrical equipment, intense movements, cargo transportation, wood sawing etc [1]. A construction site consists of several

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Peer-review under responsibility of AHFE Conference
doi:10.1016/j.promfg.2015.07.763

jobs that operate in an integrated and dynamic way in the implementation of various steps and projects, from the construction of buildings and tunnels to demolition and excavation work [2].

A relevant issue is the construction management, which generally seeks to unite the quality of its services with reduced costs, putting continued pressure on workers so the execution of the work will keep up with the schedule. In many cases, laborers need to work extra hours, with short breaks. In some cases, complying with the project deadline makes it necessary to urgently hire new employees with little knowledge of the project that is already running [3, 4]. These situations are more usual than what common sense would suggest and it is possible to notice that the physical and mental integrity of workers is constantly strained.

In this context, protection is crucial to the execution of those activities safely and comfortably. Safety in construction has been researched for a long time and has become a major challenge for several reasons, such as diversity of the activities performed, the dynamic characteristics of construction, the complexity of projects, the exposure of workers to harsh weather, the work done at heights etc. These various aspects expose workers to situations that can cause injury, illness and even death.

In this scenario situations of negligence, carelessness and improvisation are noticed, either for lack of training and basic instructions or by lack of effective supervision from competent bodies at public or private entities. This causes the ocurrence of a large number of factors that can become labor accidents [5].

Among the reasons that cause and worsen work-related accidents are the lack of adequate training to perform tasks, of adequate equipment, and of procedural instructions provided by the employer [6]. A type of management to enable the generation of solutions for bringing better technical quality and a better cost / benefit ratio, providing effective actions related to quality of life and care for the needs of workers, could optimize the activities of the construction site and reduce the possibility of work-related accidents.

The focus should always be on the human factor and include not only the transmission of technical information, but also a psychological support linked with the necessity to raise the workers' awareness. This article will introduce these issues, ranging from risk perception to the technical information contained in regulatory standards. At the end, a study case on construction sites will be presented.

2. Risk perception and labor accidents

Every labor activity has its degree of risk, regardless of the task to be performed. Following this thought, it is important for the employee to recognize that at work and in the workplace it is important to follow procedures that can ensure personal as well as collective safety. Security goes beyond the use of specific equipment, but mainly includes knowledge, awareness and decision making aiming to proceed safely during the workday.

The perception of risks is an important and decisive factor for the worker; after all, this conception becomes a kind of psychological defense mechanism from the conditions found at the job [7]. Having an understanding of the risks helps workers to protect themselves from potential accidents. However, research on the perception of accident risks in the workplace is still a recent study area, in addition to being complex and wide.

This complexity arises from the fact that the formulation of these perceptions is beyond the knowledge of safety standards and includes external factors and social issues related to the beliefs, attitudes, feelings, reviews and social representations of the individual [8]. Knowledge of the work situation and the risks that an activity poses is crucial. This knowledge is directly linked to the way employees think and analyze the forms of risk to which they are exposed [9]. In this sense we can understand that this knowledge is quite subjective.

That is, the worker knows well that the activity is dangerous in all its stages, has experience in his position, relies on equipment and believes that the risk is normal. Given these factors, workers can in a particular moment forget or forfeit some security measures, from the act of wearing a safety belt to using any of the Personal Protective Equipment (PPE). The routine generated by work on a daily basis can cause the reduction of risk perception and it is precisely in these times that accidents happen.

However, the perception of risk has other factors that may influence the understanding of hazardous situations at work [9]:

- Individual factors - physical and mental condition in which the worker is performing.
- Work environment - physical conditions / labor infrastructure and environmental comfort.

- Organizational factors - bullying, monotony etc.

Although the purpose of this article is not the analysis of issues related to risk perception, one can understand the complexity and multiplicity of areas that can influence directly or indirectly a risk situation. When this discussion is introduced in the civil work environment and the implementation of work at heights, it helps to explain why some workers behave in unsafe, careless and overconfident manners in a dangerous work environment.

To emphasize this troublesome situation it is worth mentioning the research conducted by the Brazilian Ministry of Social Security through the Statistical Yearbook of Social Security 2013. This survey reports that in 2012 there were in Brazil 49,648 work accidents involving the sub-group so called "workers of quarrying and construction industries ", according to the Brazilian Classification of Occupations-CBO [10]. A very high and worrying number.

The civil construction activity has specific security-related work legislation that ranges from information on proper training to health checks on workers and equipment specifications for machinery and tools.

Prevention of occupational accidents has multiple perspectives, from security management to the acquisition of safer technologies [11]. It is believed that if the parameters of regulatory standards are adhered to and implemented correctly, there is a great possibility that the work environment will become safer.

3. Regulatory Standards in Brazil and Uruguay

At any job it is essential to follow parameters and procedures that can ensure the exercise of work activities with greater safety, effectiveness, and comfort. The area of civil construction in Brazil is the one which shows the highest number of work accidents, despite having specific regulatory standards.

Brazil has 36 Regulatory Norms (NR) whose main objectives are to regulate and guide the required procedures related to safety and occupational medicine. The NR-18 standards (conditions and working environment in the construction industry) and NR-35 (Work at heights), are directly related to construction.

As for ergonomics, Brazil has the NR-17 standard, which sets different parameters that allow the adjustment of working conditions to the psychophysiological characteristics of workers in order to provide maximum comfort and safety, as well as efficient [12].

While ergonomics in Brazil is represented by the Brazilian Association of Ergonomics (ABERGO), Uruguay has the Uruguayan Association of Ergonomics (ADUERGO). These two associations are part of the Latin American Union of Ergonomics (ULAERGO), which was founded in 2002 and has 10 member countries. Cuba is now in the legalization process.

The Brazilian NR-35 standard seeks to deploy an understanding of management, good security practices and techniques for work done at heights, improving the perception and ensuring the maintenance of healthy and safe working environments. It aims to protect workers from the risks in activities at heights of 2m above the lower level where there is a risk of falling. It covers the planning, organization and execution of the work, the preparation of Risk Analysis, rescue, technical glossary. Annex I refers to the use of ropes in the workplace [13].

In Uruguay, the Ministry of Labor and Social Security created Decree No. 125/014 (May 7, 2014) to meet the needs of construction workers and to adjust and update the elements and risk prevention management. Called "Seguridad e Hygiene en la Industria de la Construcción", this decree came to replace the previous 1995 Decree (No. 89/995) because it was no longer meeting the new design methodologies, the increase in this activity across the country. Also, it did not fully cover the risk situations [14].

This decree regulates activities related to construction of any kind, including architecture and engineering works such as construction of buildings, roads, bridges, tunnels etc. It addresses several issues such as general health conditions, construction sites, physical and ergonomic risks (Articles 52-61), collective protection, machinery (including equipment and tools), lifting and transport equipment, demolition, work with explosives and gases, electrical installations, signaling, protective equipment, safety services at work etc.

Chapter IV (Articles 74-122) is called "scaffolding and auxiliary equipment for working at heights" and deals with specific issues related to working at heights.

There are similarities between the security legislation of Brazil and Uruguay, such as:

- Prerequisites related to structure, inspection, connection elements, endurance, storage, use and types of equipment and scaffolding.
- Specific health checks (physical and psychological) for workers performing work at heights.
- Requirements, planning, documentation, methodologies, number of workers and working techniques taking security into account.
- Personal and collective protective equipment, as well as use of tools, equipment and materials in accordance with accepted standards.
- Communication and signaling system based on accident risk management.
- Obligations of the employer and workers, including preparation and adequate training.

4. Participatory ergonomics and Macroergonomics

Ergonomics has emerged as a multidisciplinary scientific discipline that helps prevent and minimize the risk of accidents at work. Some occupational activities in construction require a significant strain on muscles and ligaments. There are several functions in construction, such as mason, helper, painter, general assistant, fitter and more. All perform specific tasks that require excessive strain that can cause lesions in the short, medium or long term [15].

Using the methods and principles of ergonomics minimizes these physical problems. However, ergonomics has several business areas that go beyond the aspects of anatomy of the human body and biomechanics. In this case, where neglect and the lack of security are discussed, participatory management can transform labor relations and the way workers see their jobs.

Usually there is a gap between the construction workers and the board of directors. The technician (engineer or architect) is the professional who is daily following the execution of the tasks on the construction site and in the workplace. But the board is usually indoors and has no direct contact with the workers nor understands their needs or monitors their activities. In this sense ergonomics can contribute to decreasing this distance.

Macroergonomics is based on a participatory approach. It generates a greater relationship between all involved in working with the objective of contributing to actions that can reduce errors, increase productivity and develop a more effective and useful communication link between the various levels of the organization [16].

Macroergonomics allows lower level employees with more information about the whole process who can contribute their experience. There is an exchange of knowledge between the levels that normally do not occur in companies.

This harmony can increase the possibilities of the working environment to have professionals working effectively in productivity and quality of services and in the workers' psychosocial health and mutual motivation. Of course, the system security and those involved in it benefit too [17].

The involvement in a more participatory way allows workers to increase critical thinking, perception and understanding of the importance of their activities and safety in the workplace.

5. Case study

This case study aims to demonstrate that even though there is a specific legislation regulating the activities of civil construction in Brazil and Uruguay, they are not sufficient to ensure genuine security for workers. A descriptive and exploratory research was made and the case study took place in Recife, Brazil and in the capital of Uruguay, Montevideo. These cities receive constant investments in the construction sector and in both of them there is a significant amount of construction in progress.

Visits were made to five construction sites in each city, performance was analyzed, the most serious situations were observed and many photos were taken. There was a comparison between the irregular and alarming situation and the security procedures contained in the safety standards. Figure 01 was made on Recife. Figure 02 was made in Montevideo.

(a) (b)

Fig. 1 Situations in Recife. Construction sites number (a) 1 and (b) 5.

(c) (d)

Fig. 2 Situations in Montevideo. Construction sites number (c) 8 and (d) 10.

It was observed in the two cities that on several occasions the safety procedures did not follow the recommendations of their respective legislation. One did not take the type of construction into consideration, except if the workers were performing their activities at over 2 meters high and if there was danger of falling, as this condition is considered work at height.

The observation time for each construction site was 1 hour in the morning and one hour in the afternoon. The most common problems are listed in the table below. Numbers 1 to 5 correspond to construction sites in Recife, Brazil (BRA). Numbers 6-10 are construction sites in Montevideo, Uruguay (URU).

Table 1. The most common problems found

	BRA					URU				
Problems found	01	02	03	04	05	06	07	08	09	10
Improvisation in the use of equipment	X	-	-	X	X	X	-	X	X	X
Poor storage of materials	-	X	X	X	-	-	X	X	X	X
Incorrect postures	X	X	X	X	X	X	X	X	X	X
Prolonged conversations between employees during risk activities	X	-	X	X	-	X	-	X	-	-
Lack of Personal Protective Equipment (PPE)	X	-	-	X	X	-	-	X	-	X
Lack of fall protection equipment	-	-	-	X	X	X	X	X	-	-
Execution of activities close to areas without fall protection	-	-	-	X	-	-	X	X	X	-
Anchor improvisation for hanging chairs	-	X	X	-	-	-	-	X	-	X
Improvisation of ladders and scaffolding	-	-	-	X	-	X	X	X	-	X
Material being left on public roads	-	-	-	-	-	-	-	X	-	-
Exposure to aerodispersoid particles	X	X	-	-	X	-	X	-	-	X

The table above shows that in several construction sites visited there were situations of recklessness and negligence towards safety. There were accident risks even for people walking in the vicinity of the construction site, as in case # 8, where there was construction material being lifted over the sidewalk.

Even with collective protective equipment there was not a worker on the sidewalk to warn the people walking by. Those situations are considered serious, even if the insecurity attitude lasts for a short period. A quick chat or a quick maneuver or wrong move, if implemented without proper security, can cause serious accidents.

The following are some suggestions of actions that can generate improvements in safety at construction sites and to help reducing risk situations. The work should be participative and include all those involved, from masons to engineers. This way, working as a team, it is possible to reduce the number of work accidents.

- Security must be understood, assimilated and integrated with all the project team through training.
- Worker participation with the Board in the management of safety is essential.
- The choice and use of equipment and components certified by technical standards is very important as well as the condition of construction materials.
- Risk management and the practice of its principles must be constant, not just in training situations.
- Safety-related procedures should be prioritized, with no bureaucracy.
- Participation of workers in training should be permanent.
- Addressing cognitive issues and risk perception in the trainings is fundamental, as well as seeking to bring understanding and risk assessment in the performed tasks, including the risk factors.
- Intense presence of supervisors at the construction site is mandatory.
- Organizing the workplace and the production layout thoroughly is a must.
- Following the work schedule closely is important, avoiding work overload at the end of the job.
- Providing supervisors with feedback about any incident at work must be constant.

6. Conclusions

Although both Brazil and Uruguay have specific rules for work safety, working at heights and ergonomics, it was still possible to see from the examples that the construction workers rely in self-confidence and experience to perform their activities.

And often they do not take the proper precautions and do not follow minimum safety procedures. It is important to have a more effective, active and participative risk management, involving the management of the companies, labor safety professionals, ergonomists and workers.

Workers must take courses and acquire additional and complementary information, recycle their knowledge and get proper training to be able to identify risk factors in their activities and take proper care. In this way there will be benefits not only for workers and businesses, but also for the public health system, the social security system and also for workers' families.

Acknowledgements

The authors thanks to the CNPQ-National Council for the Development of Science and Technology, Brazil – for sponsoring their research at Federal University of Pernambuco, from which this article is extracted and Marcelo Soares for his valuable supervision.

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